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Analysis of Climate Change Knowledge and Capacity Needs of Rural Women Farmers in Southern Nigeria

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ABSTRACT

The study analysed climate change knowledge and capacity needs of rural women crop farmers in Southern Nigeria. Data was collected from 420 women farmers selected through a multi-stage sampling procedure using a questionnaire, interview schedule and key informant interviews. Descriptive statistics, Analysis of Variance and Ordered Probit Regression analysis were used to analyse the data collected. Knowledge of the management of resistant crop varieties ($\bar{X}$ = 3.48), use of improved farming technologies ($\bar{X}$ = 3.48) and access to credit facilities for adaptation purposes ($\bar{X}$ = 3.46) were the major areas of knowledge and capacity needs of the rural women farmers. Marital status, educational level, and access to credit influenced rural women farmers' knowledge and capacity needs. Results further showed a significant difference in the knowledge and capacity needs of rural women farmers across the six states of southern Nigeria used for the study. Climate change intervention programmes and policies in Nigeria need to take cognisance of some socioeconomic characteristics of rural women farmers that influenced their knowledge and capacity needs, as these could provide deeper insight into developing a more impactful intervention programme and policy.

Keywords: Rural Women, Information Needs, Crop Farmers, Capacity Needs, Climate Change Adaptation

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1. INTRODUCTION

Climate change is already having a global impact on smallholder farming systems in the tropics, their livelihoods, and ecosystems, as well as poor rural households in middle and low-income countries who bear the brunt of the burden due to their heavy dependence on rain-fed agriculture (Omerkhil *et al*., 2020; Das *et al*., 2020; Notre Dame Global Adaptation Initiative [ND-GAIN], 2021). Climate change affects humans, the environment, agriculture and other sectors, though it has more effects on agriculture than any other economic sector (Intergovernmental Panel for Climate Change [IPCC], 2014). Nigeria is an agrarian country with about 6% of its land area estimated to be exposed to extreme weather events, as evident in extreme variations in rainfall patterns, droughts, relative humidity and varying temperature fluctuations (Sokoto *et al*., 2016; Adhvaryu *et al*., 2019). Climate change leads to losses in agricultural productivity, threatening the sustainability of food production among small-scale rural communities, food security, income and welfare of farm families (Food and Agriculture Organisation, 2018; Henri-Ukoha, 2020; Atube *et al*., 2021; Ifeanyi-obi *et al*., 2022). The recent increase in rural-urban migration in Nigeria and reduced streamflow have also been attributed to the changing climate (Cattaneo & Massetti, 2019; Akinwumi *et al*., 2020). The issue of climate change and its impacts remains a worldwide concern in the next century and beyond.

Climate information and knowledge are required to equip farmers to adopt proactive measures and decisions that reduce their vulnerability to climate risks. The relevance of timely climate information delivery and knowledge building in agriculture in minimising the negative impacts of climate disasters cannot be over-emphasised (Carr *et al*., 2016; Apgar *et al*., 2017; Ketiem *et al*., 2017; Ozor & Nyambane, 2018; Ketiem *et al*., 2017; Soares *et al*., 2018; Naab *et al*., 2019; Paparrizos *et al*., 2020; Ifeanyi-obi & Ekere, 2021). For instance, timely climate information can help farmers to achieve favourable weather and climate conditions, which translates to social and economic opportunities, enhanced farm income, reduction in costs of inputs as well as economic loss from climate risks and uncertainties (Nyadzi, 2019; Rahaman, 2020). However, farmers in Southern Nigeria depend on their experience and traditional information base for their farm practices while making farm decisions. The Nigerian Meteorological Agency is the government arm responsible for generating weather information

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

in Nigeria. It has been observed that the form of this climate information delivery does not support understanding on the farmers' side as most of the information is delivered in a highly technical scientific manner. Onyango *et al.* (2014) complained that even when weather and climate information is provided to farmers, the current form of delivery does not support their operational decisions. These decisions include timing of land preparation, planting time, type of seed or likelihood of severe weather. This is worsened by their inadequate access to considerable location and time-specific climate information services (Rashid *et al*., 2014; Kumar *et al*., 2020), consequently making them vulnerable to climate change impacts. The Agricultural Development Programme (ADP) is the government arm primarily responsible for agricultural advisory services in Nigeria. This unit faces the challenge of manpower shortage and inadequate resources for service delivery. This has affected her ability to deliver timely advisory services, particularly in climate change.

Vulnerability is exacerbated by a lack of reliable weather and climate information necessary to support adaptation to more resilient farming practices (Onyango *et al*., 2014). However, access to information and capacity building for farmers on climate change knowledge is germane in improving their resilience to climate risks and impact (Zuma-Netshiukhwi *et al*., 2016). This, therefore, calls for measures to enhance the farmer's capacity to access timely climate information given the concerns raised. Several works have been conducted on climate information and knowledge needs of farmers (Onyango *et al*., 2013; Feleke, 2015; Kruk *et al*., 2017; Mareverwa, 2018; Muita *et al*., 2021), but a few addressed the climate knowledge and capacity needs of farmers in Southern Nigeria. The preceding left a knowledge gap, which this study intends to fill. To address this issue, the study will empirically assess the climate change knowledge and capacity needs of rural women crop farmers in Southern Nigeria the capacity of farmers in terms of their timely and reliable climate.

2. OBJECTIVES OF THE STUDY

The broad objective of the study was to analyse climate change knowledge and capacity needs of rural women crop farmers in Southern Nigeria. The specific objectives were to:

1. Describe the socioeconomic characteristics of rural women farmers in the study area.

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

2. Determine climate change adaptation knowledge and capacity needs of rural women farmers in the study area.
3. Determine the relationship between rural women farmer's knowledge and capacity needs and their socioeconomic characteristics.
4. Assess differences in the climate change adaptation knowledge and capacity needs of rural women farmers in southern Nigeria.

3. THEORETICAL AND CONCEPTUAL FRAMEWORK

The quality of life one lives, and one's existence in totality, depends hugely on the healthiness of their environment. Even though one's environment is a key determinant of one's existence, knowingly and unknowingly, in their quest to earn a living and meet their daily needs, has continued to exert undue pressure on their environment, resulting in mainly negative consequences. Many of today's environmental issues are increasingly the result of human actions, personal consumer decisions, and small and large business activities (Akintunde, 2017). One of such many problems is the issue of climate change, which has been established to be mainly induced by human activities that encourage the emission of greenhouse gases (GHGs). Climate change has exerted adverse negative effects on all sectors of the economy, particularly the agricultural sector of developing countries (like Nigeria), which depends mainly on weather signals.

Most earlier adaptation efforts focused on identifying adaptation strategies and developing technologies to facilitate adaptation. It is important to note that knowledge predisposes an individual to adapt. Knowledge influences attitude, and a positive attitude stimulates positive environmental behaviour. Earlier and later researchers' findings show a correlation between knowledge and behaviour (Bagozzi & Burnkrant, 1979; Fazio & Zanna, 1978, 2006; Ajzen, 2005).

Recent trends on climate change issues have shown that the vulnerability of an individual to climate change is not dependent solely on the extent of climate change events but also on some key socioeconomic factors, including the individual's level of knowledge as well as the traditional belief system and practices existing in an individual's local setting. These factors influence an individual/system's ability to respond effectively to climate change, hence the

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

need to build farmer climate change knowledge. As the effects of climate change continue to intensify and the need for increasing adaptation action grows, it becomes pertinent to strengthen farmer's knowledge of climate change to stimulate responsible behavioural change. Mann *et al*. (2020) stated that it is no longer enough to help individuals understand ecosystems; there is a need to go beyond awareness and knowledge and into the realm of behaviour change. This research aims to support rural women in developing environmentally responsible behaviour (ERB) through increasing their knowledge of climate change and factors influencing effective adaptation. Effective knowledge building can only happen when the knowledge gap is identified, and the knowledge building is structured to address their knowledge needs adequately. Akintode (2017) suggested three theories to aid the examination and understanding of the Environmentally Responsible Behavior (ERB) concept. They are the Primitive Model, Hines's Model of Environmentally Responsible Behaviour (Hines *et al*., 1987), and Ajzen and Fishbein's reasoned/responsible action theory. The study is based on Hines, Hungerford, and Tomera's (1987) theory of Environmentally Responsible Behaviour (ERB) in Akintunde (2017). The model stated that there must be an intention to act environmentally friendly. It proposes five major factors influencing environmentally responsible behaviour: intention to act, locus of control, attitudes, sense of personal responsibility, and knowledge.

This research recognises that women crop farmers already intend to act due to the numerous threats and risks posed to their farming activities by climate change. Still, they cannot act effectively due to poor knowledge of climate change and other numerous socioeconomic factors militating against successful adaptation, particularly social exclusion. The study proposes that equipping women with climate change knowledge will strengthen them to embrace environmentally responsible behaviour and develop control over climate risks and threats. Furthermore, it noted that holistic knowledge of climate change and influencing factors to adaptation will help create a sense of personal responsibility to contribute to climate change adaptation discourse among rural women. The research intends to contribute not just to building the knowledge of rural women crop farmers on the concepts of climate change but also to understanding other factors that may influence their attitude and adaptive behaviours, hence stimulating responsible action.

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

The conceptual framework proposes that rural women crop farmer's response to climate change is not influenced by only their level of exposure to and intensity of climate change effects; the knowledge of climate change and other key socioeconomic factors play a vital role in their willingness and choice of response to climate change effects. It conceptualised that some socioeconomic factors may affect women crop farmers' capacity to adapt in response to climate change effects. It assumes that knowledge of these socioeconomic factors could facilitate finding commensurate strategies to alleviate climate change effects. The framework assumes a strong relationship between the dependent variable, rural women's climate change knowledge and capacity needs and the independent variables, socioeconomic characteristics.

4. METHODOLOGY

This study was conducted in Southern Nigeria. The country has a total area of 923,768 square kilometres, which falls within Latitude: 9° 03' 60.00" N and Longitude: 7° 28' 59.99" E. Rainfall is the crucial climatic variable in the country with a marked alternation of wet and dry seasons in most areas. Rainfall is experienced almost throughout the year in the country, with the most significant occurring between April and October. The Mean annual temperature for Nigeria is 26.9^{o}C, with average monthly temperatures ranging between 24^{O}C and 30^{O}C.

The southern part of Nigeria experiences strong rainfall events during the rainy season, usually between March and October. Rainfall amount in the region rises above 2,000mm and can reach 4,000mm in the Niger Delta zone of the region during such time (Nigeria, 2020). The central livelihood patterns of the people of rural areas range from farming to petty trading, as well as artisans and civil servants.

A multi-stage sampling procedure was used to select the sample for this study. The first stage comprises the random selection of two states from each of the three geopolitical zones that make up Southern Nigeria. The States are Abia and Enugu (southeast zone), Rivers and Akwa Ibom (SouthSouth zone) and Oyo and Osun (SouthWest zone). The second stage comprises the purposive selection of two agricultural zones from each state selected. This was based on the dominance of rural areas in the zone. In the third stage, one agricultural block was chosen from each of the selected twelve agricultural zones, giving a total of twelve agricultural blocks for the study. The final stage comprised the selection of one agricultural circle from each block. The circles selected were Ovom, Amakama, Umunaa, Umuoke, Abua odua, Olakwo 1, Ikot

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

Ekpan, Ikot Esikan, Oluyole, Kajola, Agbora and Akola. The study was targeted at only rural women farmers in crop production; hence, the list of all registered women crop farmers in these circles was accessed from the agricultural extension agents, and 35 female crop farmers were selected, giving a total of 420 women crop farmers for the study.

Data was collected with a questionnaire and interview schedule where the farmer was illiterate. In addition, key informant interviews were conducted with key women leaders to help get in-depth knowledge of the subject matter and triangulate information collected during questionnaire administration.

Socioeconomic characteristics of the rural women crop farmers were analysed using mean, frequency counts and percentages. The rural women's climate change adaptation and capacity needs were captured using a 4-point Likert scale of Very High, High, Low and Very Low, which was assigned weights of 4, 3, 2 and 1, respectively. A midpoint of 2.5 was obtained, implying that rural women's climate change information and capacity needs are low in statements with a mean value of below 2.5 and high in those with a mean value of 2.5 and above. The relationship between the rural women crop farmer's information, capacity needs, and socioeconomic characteristics was determined using the Ordered Probit Regression model. In contrast, Analysis of Variance (ANOVA) was used to assess differences in the climate change adaptation information and capacity needs among rural women in southern Nigeria. The model specification for the OLS and ANOVA are stated below:

4.1. Model Specification

4.1.1. Relationship Between Rural Women Crop Farmers' Knowledge and Capacity Needs and Their Socioeconomic Characteristics

The relationship between rural crop women farmers' knowledge and socioeconomic characteristics was assessed using an ordered probit regression model. The error term in the ordered probit model is assumed to be normally distributed with zero mean and constant variance (variance = 1) (Edriss, 2019). The ordered probit model is therefore stated as follows:

$$Y_i^* = \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_{10} X_{10i} + \varepsilon_i$$

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

$$Y_i = \begin{cases} 1 = Very\ low \\ 2 = Low \\ 3 = High \\ 4 = Very\ high \end{cases}$$

Where Y represents the ordered or ranked response of climate change knowledge and capacity need of rural crop farmers measured with a four point-Likert scale of Very High (4), High (3), Low (2) and Very Low (1), X_1 represents age (measured in years), X_2 represents marital status (Single = 1, Separated = 2, Married = 3), X_3 represents educational level (1 = no formal education, 2 = primary, 3 = Secondary, 4 = tertiary), X_4 represents farming experience (measured in number of years), X_5 represents access to credit (No = 0, Yes = 1), X_6 represents membership of cooperative association (No = 0, Yes = 1), X_7 represents extension agent visit (No = 0, Yes = 1), X_8 represents farm size (in numbers), X_9 represents monthly income from farming activities (in Naira), X_{10} represents amount of credit accessed (in Naira), and e = Error term.

Furthermore, the marginal effect of the model is estimated and used for result discussions, given the non-linearity and non-probabilistic nature of the coefficients. Hence, marginal effect estimates the probability of each outcome change as each explanatory variable changes (Edriss, 2019). Therefore, each dependent outcome variable (Y = 1, 2, 3, 4) would have its probability of occurrence as the independent variable changes.

4.1.2. Difference in Climate Change Adaptation Knowledge and Capacity Needs of Rural Women in Southern Nigeria

Analysis of Variance was employed to assess the difference in climate change adaptation knowledge and capacity needs among rural women in southern Nigeria. The result was subjected to the Turkey HSD Comparison test to identify where the variance in information and capacity needs among rural women crop farmers in southern Nigeria lies.

5. RESULTS AND DISCUSSION

5.1. Socioeconomic Characteristics of Rural Women Crop Farmers

Results in Table 1 show the socioeconomic characteristics of the rural women crop farmers in the zone. It shows that 91% of the rural women are married with a mean age and household size of 48 years and five persons, respectively. Most of them had secondary education (51%).

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

They were majorly full-time farmers (95%) with average farm size and farming experience of 0.64 Ha and 13 years. Both inheritance and lease (65%) were the major sources of farmland, while farm labour was accessed mainly through hired and family supply (86%). The average monthly income is N33,130. Only 33% have access to credit facilities, while 43% are cooperative association members. Extension visits are relatively existing in the area as 48% indicated being visited by an extension agent. Cassava (96%), Maize (93%) and Vegetables (93%) were the major crops cultivated in the zone.

The result above indicates that most rural women could read and write, and 58% had at least a secondary school certificate. When farmers are educated, accessing information through written channels (Ninh, 2021; Yongshan & Yonghe, 2020; Akanni, 2019) and mobile phones could be easier. This holds a lot of potential for their overall productivity as access to information is vital in making rational farm decisions and timely responses to extreme weather events.

Also, membership in a cooperative society could be a veritable factor in promoting information dissemination among farmers (Oluwaseun & Trudy, 2014), as many access farm information through fellow cooperative members. Membership in a cooperative society among rural women is relatively low, which is a militating factor in effective information dissemination among them.

Furthermore, the result shows that a good percentage of rural women have yet to be visited by agricultural extension agents. This is disturbing, bearing in mind that the agricultural extension agents are the primary personnel mandated by agricultural advisory services in the country. The grossly inadequate extension visits may be attributed to the country's low number of agricultural extension agents. The extension agent-to-farmer ratio remains below the expected level (1:200) for effective training and visit extension, which is the extension approach used in Nigeria. Currently, the country has an agricultural extension agent-to-farmer ratio of 1:3000 (Sennuga *et al*., 2020), making it extremely difficult for the extension agents to disseminate information to the farm population in the country effectively. This is a pointer to the cogent need to harness other means/channels of agricultural information dissemination that could complement the few available extension agents. Leveraging mobile phones for e-extension services holds excellent potential in this regard.

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

TABLE 1: Socioeconomic Characteristics of Rural Women Crop Farmers in Southern Nigeria

S/N	Variable	Frequency	Percentage (%)	Mean
1	Age (Years)			48
	≥ 30	45	11.0	
	31 - 50	195	47.0	
	51 – 70	180	42.0	
2	Marital status			
	Single	15	3.0	
	Separated	24	6.0	
	Married	381	91.0	
3	Educational Status			
	No formal education	54	13	
	Primary education	122	29.0	
	Secondary education	212	51.0	
	Tertiary education	32	7.0	
4	Farming Status			
	Part time farmers	21	5.0	
	Full time farmers	399	95.0	
5	Household size			5
	≤ 5 Persons	218	52.0	
	6 - 10	45	45.0	
	< 10 Persons	16	3.0	
6	Farming experience (years)			13
	1 - 10	42	10.0	
	11 - 20	80	18.0	
	21 – 30	95	23.0	
	31 – 40	98	24.0	
	> 40	105	25.0	

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

7	Farm Size (Ha)			
	<1	352	84.3	0.64
	1 - 2	55	12.6	
	Above 2	13	3.1	
8	Source of Farmland			
	Lease	89	21.0	
	Purchase	15	4.0	
	Inheritance	42	10.0	
	Both Inheritance and Lease	274	65	
9	Source of Farm Labour			
	Hired	49	12.0	
	Family supplied	9	2.0	
	Both Hired and Family Supplied	362	86.0	
10	Monthly income from Farming activities (Naira)			33,130
	≤ 20,000	122	29.0	
	21,000 – 40,000	226	54.0	
	41,000 – 60,000	49	11.0	
	61,000 – 80,000	12	3.0	
	81,000 – 100,000	3	1.0	
	> 100,000	8	2.0	
11	Access to credit facilities in the past	138	33.0	
12	Membership of Cooperative society	180	43.0	
13	Visited by Extension Agent	202	48	
14	*Major crops cultivated			
	Cassava	408	96	
	Maize	393	93	
	Vegetables	393	93	
	Yam	340	81	
	Cocoyam	313	74	
	Plantain	313	74	

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

Pineapple	167	40
Rice	80	19

***Multiple response**

5.2. Climate Change Adaptation Knowledge and Capacity Needs of Rural Women Crop Farmers

The level of knowledge and capacity in climate change adaptation among rural women crop farmers was found to be generally low ($\bar{X}$ = 1.78). This indicates the compelling need to build their knowledge and capacity in climate change adaptation. Almost all (97.4%) women indicated they needed to develop their knowledge and capacity in climate change adaptation. Table 2 shows the different areas of knowledge and capacity needs indicated by the rural women crop farmers. The significant areas of information and capacity need indicated by the rural women were knowledge on resistant crops ($\bar{X}$ = 3.48), use of improved technologies ($\bar{X}$ = 3.48), easy access to credit facilities for adaptation purposes ($\bar{X}$ = 3.46), capacity on adopting Climate Smart Agriculture (CSA) practices ($\bar{X}$ = 3.46), knowledge and skill in pest control practices ($\bar{X}$ = 3.44), knowledge on crop vulnerability to climate change ($\bar{X}$ = 3.44), knowledge and capacity on group dynamism for better adaptation to climate change ($\bar{X}$ = 3.40) and knowledge on existing government climate change adaptation initiatives and policies ($\bar{X}$ = 3.40).

A similar result was found by Okoro, Agwu and Anugwa (2016), who identified the use of improved varieties, occupational diversification, and change in timing of farm operations, among others, as the climate change knowledge needs of farmers in Enugu state. Egbule and Agwu (2014) in same line found that men and women farmers require knowledge on how bush burning (80.9% and 81.5%) and deforestation (72.6% and 76.4%) activities bring about climate change, further indicating that climate change information needs of men and women differ.

TABLE 2: Climate Change Adaptation Knowledge and Capacity Needs of Rural Women Crop Farmers in Southern Nigeria

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

Climate Change Adaptation in Knowledge and Capacity Needs of Rural Women Farmers	**Very High**	**High**	**Low**	**Very Low**	**Mean**
I need to acquire more knowledge of existing government climate change adaptation initiatives and policies	171(41.8)	230(56.2)	8(2.0)		3.40**
I need to develop my capacity in crop management practices for climate change adaptation	173(42.3)	224(54.8)	12(2.9)		3.29**
My capacity to upscale available Indigenous adaptation practices needs to be improved	164(40.1)	224(54.8)	21(5.1)		3.35**
Knowledge of accessing adaptation information using social media needs to be improved	159(38.9)	231(56.5)	17(4.2)	2(0.5)	3.34**
Knowledge of crop vulnerability to climate change	196(47.9)	197(48.2)	16(3.9)		3.44**
Need to develop my knowledge and capacity in alternative livelihood means	159(38.9)	236(57.7)	14(3.4)		3.35**
Need to develop my capacity in soil management practices	170(41.6)	223(54.5)	15(3.7)	1(2)	3.37**
My knowledge and skill in the use of Agro-chemicals need to be developed	183(44.7)	219(53.5)	7(1.7)		3.34**
Need more knowledge and skill in Pest control practices	188(46.0)	212(51.8)	9(2.2)		3.44**
More knowledge of non-environmentally friendly farming practices	172(42.1)	223(54.5)	14(3.4)		3.39**
Knowledge of the vulnerability of different livelihoods to climate change	173(42.3)	217(53.1)	19(4.6)		3.38**

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

Knowledge of better understanding of weather information	162(39.6)	236(57.7)	11(2.7)		3.37**
Need more knowledge and capacity in water management practices	1148(36.2)	223(54.5)	38(9.3)		3.27**
Knowledge and capacity on the use of improved technologies need to be developed	207(50.6)	193(47.2)	9(2.2)		3.48**
More capacity for adopting Climate Smart Agriculture (CSA) practices	198(48.4)	204(49.9)	5(1.2)	2(0.5)	3.46**
More knowledge on how to access credit facilities to facilitate adaptation	197(48.2)	203(49.6)	8(2.0)	1(0.2)	3.46**
More knowledge and capacity on group dynamism for better adaptation to climate change	171(41.8)	230(56.2)	8(2.0)		3.40**
More knowledge of operational land use Acts and degrees	146(35.7)	241(58.9)	22(5.4)		3.30**
Knowledge of resistant crops	210(51.3)	187(45.7)	12(2.9)		3.48**

*Low **High

5.3. Relationship Between Rural Women's Crop Farmers' Knowledge and Capacity Needs and Their Socioeconomic Characteristics

Table 3 shows the descriptive statistics of women concerning their knowledge and capacity needs. The result suggests that the percentage of women with very high knowledge and capacity needs is 41.73%. In addition, the percentage of women with high knowledge and capacity needs is 57.54%, while 0.73% of women have low knowledge and capacity needs, and 0% have very low knowledge and capacity needs. This implies that the number of women who require knowledge and capacity building was 171 women (very high need) and 235 women (high need). In comparison, only about three women require minimal to no capacity development (low need).

TABLE 3: Descriptive Statistics of the Dependent Variables

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

Variable	Mean	Std. Dev.	Min	Max
Very high	0.4172782	0.1134467	0.0727063	0.9227671
High	0.5753811	0.1136599	0.0744328	0.924543
Low	0.0073407	0.0006679	0.0027506	0.0078258
Very low	0	0	0	0

In addition, the ordered probit model is used to determine the relationship between rural women crop farmers' knowledge and capacity needs and their socioeconomic characteristics. To justify the choice of model adopted, Akaike's Information Criterion (AIC) was used to select the model that provides the best fit based on the smallest AIC value. The AIC values between ordered probit regression (AIC = 595.3143) and ordered logit regression (AIC = 595.5641) were compared for best fit. Therefore, the ordered probit model was adopted for the analysis because it fits the model better. The result of the ordered probit regression is shown in Table 4. Given that the model is not linear and the coefficients are not probabilities, the marginal effect is estimated and presented in Table 5. The marginal effect was conducted to ascertain the probabilities of each outcome.

TABLE 4: Result for the Ordered Probit Regression

Variables (n=409)	Coefficient	Standard error	p-value
Age	-0.004	0.010	0.686
Marital status: Separated	-1. 093	0.492	0.026
Married	-0.747	0.388	0.054
Primary education	-0.254	0.218	0.243
Secondary education	-0.423	0.212	0.045
Tertiary education	-0.959	0.329	0.004
Farming experience	0.002	0.009	0.831

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

Credit	-0.548	0.274	0.046
Membership in a Cooperative society	0.056	0.177	0.750
Visited by Extension Agent	0.219	0.135	0.140
Farm size	0.008	0.005	0.122
Monthly income from Farming activities (Naira)	4.85e-07	2.04e-06	0.812
Access to credit facilities in the past	3.02e-06	1.49e-06	0.042
Cut 1	-0.8599	0.4936	
Cut 2	-0.8403	0.4935	
Log-likelihood	-282.657		
LR	22.86		
p-value	0.04		

The result in Table 5 suggests that marital status plays a role in accessing crop farmers' knowledge and capacity needs. This agrees with the findings of Diouf *et al*. (2019). Hence, the probability of women requiring very high knowledge and capacity needs decreases with marital status. In contrast, it had the opposite effect on women requiring high knowledge and capacity needs ($p<0.05$). The result also shows that having a secondary and tertiary education reduced the probability of women having very high knowledge and capacity needs ($p=0.044<0.05$; $p=0.001<0.01$, respectively) by 16.7% and 35%, respectively. This implies that literate farmers may not require a lot of knowledge and capacity building.

https://doi.org/10.17159/2413-3221/2024/v52n3a15659

TABLE 5: Socioeconomic Factors Influencing Rural Women Crop Farmers' Knowledge and Capacity Needs

Variables	Very high		High		Low	
***DV= Knowledge and capacity need**	Marginal effects (Standard Error)	p-value	Marginal effects (Standard Error)	p-value	Marginal effects (Standard Error)	p-value
Age	-0.002 (0.003)	0.686	0.002 (0.004)	0.686	-6.26e-06 (0.000)	0.696
Separated	-0.415 (0.169)	0.014**	0.415 (0.169)	0.014	-0.000 (0.002)	0.961
Married	-0.288 (0.135)	0.033**	0.288 (0.134)	0.032**	0.001(0.002)	0.554
Primary education	-0.101 (0.086)	0.240	0.101 (0.086)	0.239	0.000(0.000)	0.806
Secondary education	-0.167 (0.083)	0.044**	0.167 (0.083)	0.043**	-0.000(0.000)	0.566
Tertiary education	-0.350 (0.108)	0.001***	0.352 (0.108)	0.001***	-0.002(0.002)	0.228
Farming experience	0.001 (0.003)	0.831	-0.001 (0.003)	0.831	0.000(0.000)	0.832
Credit access	-0.206 (0.098)	0.035**	0.208 (0.099)	0.036**	-0.001(0.001)	0.246
Membership of Cooperative society	0.022 (0.069)	0.750	-0.022 (0.069)	0.750	0.000 (0.000)	0.751
Visited by Extension Agent	0.085 (0.052)	0.103	-0.086 (0.052)	0.103	0.000 (0.000)	0.262
Farm size	0.003 (0.002)	0.122	-0.003 (0.002)	0.122	0.000 (0.000)	0.275

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Monthly income from Farming activities (Naira)	1.89e-07 (7.94e-07)	0.812	-1.90e-07 (7.97e-07)	0.812	7.51e-10 (3.20e-09)	0.814
Amount of credit accessed in the past	1.18e-06 (5.80e-07)	0.042**	-1.18e-06 (5.82e-07)	0.042**	4.67e-09 (3.83e-09)	0.222

DV= Dependent variable *** represent 1% significance level, ** represent 5% significance level

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On the other hand, having a secondary and tertiary education increased the probability of women having high knowledge and capacity needs ($p=0.043<0.05$; $p=0.001<0.01$, respectively) by 16.7% and 35%, respectively (Table 3). This aligns with the findings of Chen and Lu (2019) and Diouf *et al*. (2019). Chen and Lu (2019) reported that the higher the farmers' educational attainment, the higher their information needs are. In contrast, Diouf *et al*. (2019) reported that literate farmers were more likely to access climate information services. Lastly, Table 3 indicates that having access to credit reduced the probability of women having very high knowledge and capacity needs by 20.6% ($p=0.035<0.05$). However, for women with high-capacity needs, access to credit increased their probabilities by 20.8% ($p=0.036<0.05$). Therefore, farmers' ability to access credit is important to determine their capacity and knowledge needs.

5.4. Difference in the Climate Change Adaptation Knowledge and Capacity Needs of Rural Women in Southern Nigeria

A one-way between-groups analysis of variance was conducted to check differences in the climate change knowledge and capacity needs among rural women in the six states used for the study. As shown in Table 6, the result shows a statistically significant difference in the climate change adaptation knowledge and capacity needs of rural women crop farmers at $p < .05$ level: $f (5, 414) = 2.865$, $p = 0.015$.

TABLE 6: Analysis of Variance in the Climate Change Knowledge and Capacity Needs of Rural Women Crop Farmers in Southern Nigeria

Sources of variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2143.755	5	428.751	2.865	.015
Within Groups	61951.129	414	149.640		
Total	64094.883	419			

Despite reaching statistical significance, the difference in mean scores between the groups was quite small. The effect size (the strength of the difference between groups) was calculated to find out the relative magnitude of the difference between means or the amount of total variance in the dependent variable that is predictable from the knowledge of the levels of the independent variable.

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The effect size calculated using the eta-squared method was 0.03, which, according to Cohen (1988), is classified as a small effect size. It could be said that despite reaching statistical significance, the actual difference in mean scores between the groups (states) was quite small.

A post-hoc comparison test was conducted to identify precisely where the difference lies. Post-hoc comparisons using the Turkey HSD test indicated that the mean score for Abia state (M= 58.4286, SD= 17.68) differ significantly from Enugu state (M= 64.7429, SD= 7.23655) and Oyo State (M= 65.300, SD= 4.71307). This shows that the climate change information and capacity needs of rural women crop farmers in Abia State vary from those in Enugu State and Oyo State. This may be due to the peculiar effects and challenges the rural women crop farmers face in these zones. In addition, looking at the ecological zones of the states, Abia state lies in the Humid forest zone of the country, while Enugu and Oyo states lie in the Derived savannah. This could also contribute to how climate change affects them, hence different knowledge and capacity needs.

6. CONCLUSION AND RECOMMENDATIONS

The study concludes that the rural women farmers were primarily middle-aged, literate, married, and had adequate farming experience. In addition, the rural women farmers were small-scale full-time farmers with low access to extension services and cooperative society membership. As a result, farmers are deprived of benefits such as effective information dissemination regarding climate change adaptation. Hence, rural women farmers in the study area are encouraged to be members of a cooperative society and adequately receive extension services to effectively adapt to the negative effects of climate change through appropriate knowledge and capacity building. Furthermore, rural women farmers' knowledge and capacity in climate change adaptation was generally low. Therefore, farmers need to build knowledge and capacity in climate change adaptation.

Thus, marital status, level of education, and the number of credits obtained by rural women crop farmers greatly determine the farmers' need for knowledge and capacity building. Therefore, depending on the level of interest (whether for farmers requiring 'very high' knowledge and capacity building or for farmers requiring 'high' knowledge and capacity building), the unique relationships and interactions between the socioeconomic characteristics of women crop farmers

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and their knowledge and capacity need should be considered for any meaningful policies and solutions to be made.

The study further concludes that rural women crop farmers' climate change knowledge and capacity needs in Abia, Enugu, and Oyo states differ. Hence, climate change knowledge and capacity building should be based on their relative needs, given the peculiarities of each state. Therefore, researchers should consider this in future studies.

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